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EMBRYOLOGY.

Text-book of the Embryology of Invertebrates. By Dr. E. Korschelt and Dr. K. Heider. Part I. Translated from the German by Edward L. Mark and W. McM. Woodworth. Pp. xvi + 484. (London: Swan Sonnenschein and Co., 1895.)

EMBRYOLOGY "is one of the most important subjects in the whole round of Natural History." So says Darwin, and so say all zoologists who have the knowledge to appreciate, and the training and patience to deal with, the innumerable facts which constitute that most fascinating branch of their subject.

Formerly the view was held—it is even now held by some zoologists—that embryology is a subject apart from the other branches of zoology; that a man might be a complete zoologist without any knowledge of it; that it could throw but little light upon those great questions of structure which it is the ambition of comparative anatomy to solve; and that it was a study which, if it did not actually narrow the mind, took it away from that pure and sympathetic contemplation of nature, which it was the object of all true zoological teaching to call forth. To such zoologists embryology was of but small importance.

And the reason for this attitude is not far to seek. In the good old days the equipment required by the zoologist was but slight, and the facts lay bare for every one to note. A collecting-box and a bottle of spirits, a pocket-lens and, by the more advanced, a pair of forceps and a scalpel were all that were required. With such simple instruments, combined with a certain power of observation and a love for nature, which had often more of an æsthetic than a scientific character, a man might go far. But this delightful time is past—the unaided pocket-lens is now of little service, the forceps and scalpel have revealed almost all that they are capable of revealing, and the bottle of spirits requires to be supplemented by a whole complement of elaborate reagents. And if this is true of the material requisites, how much more true is it of the intellectual. In addition to the elaborate technique, the complicated instruments and the whole routine of the modern laboratory, there are the immense accumulations of knowledge which must be mastered if nature is to be questioned with any hope of success. It is this training which is often irksome; it is these instruments which cannot be used without patience and practice; which bewildered the older zoologists, and which make the way so hard for those younger men who, with a collector's or an æsthetic's love for nature, wish to pose before the world, after the manner of their fathers, as experts in an important branch of science.

But to return to our question: What is the relation of embryology to the other branches of zoology? Clearly it is an integral part of the well-known and respected science of comparative anatomy; it is the part of that science which deals with the anatomy of the organism before the attainment of sexual maturity, and, inasmuch as most animals pass through several stages of structure during their growth, the study of it is, to the scientific anatomist at least, as important as the study of the adult. One would have thought that this position would have been conceded on all hands, and that there would have been no necessity to call attention to it here. But it is not so; for there are anatomists who hold that, in solving anatomical problems, the structure of the embryo is of very small importance indeed as compared with the structure of the adult.

But embryology is more than this. It has caused the use of methods and instruments which have extended the bounds of comparative anatomy; it has brought into the field men who, in their love of nature, in their capacity for patient labour, and in their powers of accurate observation, are at least the equals of the older naturalists; and it has brought to light facts of natural history which, but for it, would have remained in darkness, and which even that zoological butterfly, the amateur naturalist, would not pass by. To mention only a few such. What more wonderful phenomena can be mentioned in the whole round of natural history than the larval development and metamorphosis of the Echinodermata; the detachment and digestion of the brain and sense organs of the larva of Phoronis on the attainment of sessile life; the growth of the worm within the larval skin of the Pilidium; the double sexual life of the Ctenophora.

Of the relation of embryology to the evolution theory, we can only shortly refer. Apart from the construction of phylogenetic histories, to which unfortunately there appears to be no end, our science is of supreme importance as affording the most unanswerable, indirect corroboration of that theory which it is possible to obtain.

But embryology has wider bearings even than these. The systematist is powerless without it. He may ignore it, he may neglect it; but if he do so, he can have no true insight into the relations of the great groups. Until embryology was a science, the Tunicata were grouped near the Mollusca; and without its aid the great Cuvier himself was led into the error of placing the Cirrepedia in the same phylum. Nor can the student of species avoid his fate. To-day he may rejoice that he at least can pass by on the other side, and leave embryology to the embryologists. But, alas! it will not be so for long; even now embryonic characters are beginning to assert their claims for recognition, and in the near future a knowledge of development will be as indispensable to the species-monger as to any other kind of zoologist.

It would thus appear that embryology has a classificatory as well as an anatomical value, and should be dealt with in works on zoology. But while in works on anatomy it is quite impossible to ignore the facts of development, it is unfortunately true that in zoological treatises, systematic embryology is either entirely neglected or else treated in such a sketchy way as to be useless, or nearly so, to the student. But in saying this, we desire to impute no blame to zoological authors, who are already overburdened with the immense mass of facts which they have to treat. Hence the necessity for books specially dealing with the subject—books which had their model and initiator in the great work on comparative embryology by F. M. Balfour. The book before us may, indeed, almost be regarded as a second edition of that work, so closely are Balfour's plan and method followed. And surely no greater praise could be given to it. Not only is the method of treatment almost identical, but the points of view from which the facts are looked at is almost exactly the same as that adopted by Balfour more than fifteen years ago. The passage—"In the group Metazoa or germ-layer animals, on the contrary, there always results a multicellular organism (cell-community or cell-corm), in which the single cells give up their independence for the good of the community, and accommodate themselves to a division of labour, in consequence of which there is brought about a diversity in the structure and function of the cells of the Metazoan organism" (Introduction, p. 1)—shows that the cell-theory in its modern form is the key-note of the work, and that the germ-layer hypothesis of Huxley and Kowalevsky still holds the prominent position assigned to it in Balfour's work. And we are very far from blaming the authors for thus adhering to the old faiths of the seventies; for though much may now be urged to diminish the importance of these hypotheses, which in their day have done yeoman's service to the furtherance of anatomical science, and though it might be argued, as has lately been done in more than one quarter, that they are moribund and powerless to lead us further in the intricate task of unravelling structure, still it would be foolish, to say the least of it, to cast them on one side in a didactic work of this kind, until some better, some more penetrating guide has been found to replace them.

After this, it is hardly necessary to say that it is our opinion that the authors are men of sound judgment, a fact which is shown in every chapter of their work. But we have said enough to indicate our admiration for the work. The authors are scholars in the best sense of the word. Their erudition is profound, their accuracy is minute, their industry and patience must be marvellous, and their critical powers are quite first-rate. In soundness and impartiality their judgment leaves nothing to be desired. So far as our knowledge goes, credit is always well apportioned, and conflicting statements are handled, if not with the consummate skill of Balfour, still in a manner which is unusual in works of the kind.

The volume before us is part i. of the German work, and deals with the Porifera, Cœlenterata, Platyhelminthes, Nematelminthes, Annelida, Echinodermata, Rotifera, Chætognatha and Enteropneusta, treated entirely in a systematic manner.

Parts ii. and iii., of which a translation is promised, complete the treatment of the invertebrata. In the authors' preface, a general part is spoken of, but so far as we know it has not yet appeared; and the vertebrata are expressly excluded from the scope of the work. This omission we hold to be a defect. The authors defend it on the ground that that department of the subject has been adequately treated recently by other hands. We entirely differ from this view; for not only do we hold that no entirely satisfactory treatment of the vertebrata has appeared since Balfour's work, but that no satisfactory treatment is possible apart from the rest of the animal kingdom. Moreover, though the phylum vertebrata is only one phylum of the animal kingdom, no scientific treatment of the subject as a whole is possible without at least a consideration of the facts of vertebrate embryology. One might as well, in a scientific treatise on chemistry, omit all reference to carbon and its compounds. We sincerely hope that the authors will change their minds, and will, when they issue the general part, append an account of vertebrate embryology.

In a work of this magnitude there must be a certain number of small mistakes and slips; but we have found surprisingly few of them. We might, however, call attention to two, which bear on subjects having a certain amount of general interest. On p. 3, it is stated that the "ectoderm germ-layer presides over the animal functions (sense, perception, locomotion)." This is of course an error; for not only are the most important muscles often endodermal in origin, but, if certain observations are to be trusted, it is highly probable that the main nervous tracts arise *in situ* in the mesoderm. On p. 31, a series of diagrams showing the structure of the canal-system in certain sponges is described as "a diagram of the development of the canal system in various sponges." This is obviously a loose statement. What the authors probably mean is, that the diagrams illustrate various conditions of the canal-system, which are actually met with in different sponges, and which may be supposed hypothetically to represent permanently stages of structure through which the more complicated canal systems have passed in phylogeny. This slip is of more importance than at first sight it may appear to be, because phylogenetic speculations, if they are to have any value at all, and not to be mere hindrances, must be described in the most precise language, and based upon the most exact ideas. It is very important at the present time, when so many loosely-conceived and worthless phylogenetic hypotheses are constantly being put forward, that the necessity for precision and clearness of thought at least should be regarded as indispensable in all attempts to trace the ancestry of living animals.

With this one exception, which is obviously a slip, this volume is happily entirely free from all blemishes of the kind. The phrase, "embryonic connective tissue," though no doubt sanctioned by usage, is one to which we take exception. The tissue so described has almost, if not quite always, nothing whatever in common with connective tissues as ordinarily conceived, but is a germinal or growing tissue which gives rise to most important organs.

The translators have performed their task with skill. There are short notices, made for the most part by the authors, of the more important memoirs which have appeared since the publication of the original in 1890. The German idiom is quite got rid of, and the book in its English form is eminently lucid and readable. The translators are to be congratulated on their work, and have earned the gratitude of all English zoologists. But, alas! there is one serious blemish. If the translators were Englishmen, we should call it an error of taste; but being Americans, we must make allowances, and put it down as another example of the curious incompleteness of their knowledge of the English language, which some Americans are known now and again to display. We all know how frequently the word *anlage* is used in German works on embryology; and we all know that some authors, notably those writing in America, refusing to use the English equivalent, have attempted to add this word to the English language. The translators of this work have not taken this course—we almost wish they had—they have decided to use an English equivalent. But instead of using the English word *rudiment*, a well-known word, a respectable word, one might almost say a classic word in the ears of English zoologists—a word which well covers the meaning of the German word "anlage," and the use of which in this sense can be productive of no confusion, they have invented a new rendering; and—O ye gods!—what a rendering!

We would pardon the ignorance of one who did not know that the first and most common meaning of the word *rudiment* is the "original of anything in its imperfect form." But the editors have not stopped short at this: they have fallen from Scylla into Charybdis; they have employed a word with the meaning of which every schoolboy is familiar—often painfully familiar—a word which has only one usage in English, and that a usage which, to all people with a sense of humour, would entirely unfit it for the present purpose, even if it were required. They have displayed an ignorance which is almost incredible in men who speak the English language, an ignorance which, while it may help us to understand certain peculiarities observable in some of their countrymen, is fraught with the most ludicrous results in the present instance. We sincerely regret that we are obliged to call attention to this blemish. It is hard upon the authors to have their work served up to the English public with such a grotesque ingredient. We feel that the publishers, who at any rate are Englishmen, should have seen to the matter, and we sincerely hope that the pages of parts ii. and iii. of this most valuable work will not be defaced by such a misuse of a well-known and old-established English word.

It only remains to say that the book is well got up. The printing is good, the illustrations are excellent, and the size is convenient.

THE EVOLUTION OF CULTIVATED PLANTS.

Plant-Breeding: being Five Lectures upon the Amelioration of Domestic Plants. By L. H. Bailey. Pp. 293. Figs. 20. (New York and London: Macmillan and Co., 1895.)

WHEN, in 1859, Darwin's "Origin of Species" first saw the light, naturalists were astonished at the large number and variety of illustrations the author derived from cultivated plants. This feeling was accentuated in 1868, when the "Variation of Animals and Plants under Domestication" appeared. Previous to that time botanists had, for the most part, ignored the productions of the horticulturists, or looked upon them as so many sources of annoyance and confusion. With the publications just mentioned, there dawned upon the minds of thinkers the notion that what was done in nature slowly and gradually had been, and was effected by the gardener rapidly and, relatively, with equal certainty.

Variation, selection, adaptation, progressive evolution were seen to constitute the basis of the work of the gardener and the "florist" in their attempts to gain new and improved varieties. Cross-breeding and hybridisation had been practised for generations. The first artificially-produced hybrid on record was raised in the beginning of the eighteenth century by Fairchild—a gardener. It was a hybrid Pink. After him came Bradley, Logan, Philip Miller, who each and all carried on their experiments on evolutionary lines. With Thomas Andrew Knight and Dean Herbert, we are brought down to modern times. They were great gardeners. Assuredly they were great evolutionists. And the work is going on day by day with more activity than ever. In addition to the constant improvement recognised in the case of agricultural and garden plants, the evidence of which may be seen in the seedsmen's trial-grounds and in the experimental garden of the Royal Horticultural Society at Chiswick, there is a positive production of new forms, so different from pre-existing ones, that were the history not known they might be thought to constitute new genera, or, at any rate, new sections. Take the tuberous Begonia, for instance. Thirty years ago or so, there was nothing like it either in nature or in gardens. Now, by the blending of various species, entirely new races have been produced; and these, to a large extent, are reproduced from seed. From the seedlings selection is made, and so the progress goes on. But some will say, Will they not die out if not looked after by the gardener? Of course they will; but are there no such things as retrogressions and extinctions in nature? The Begonias in question would doubtless die here if uncared for, as they are not suited to the climatal environment; but they would at least have a very good chance if removed to the Andean forests, whence their progenitors sprang.

The gardener, moreover, is often in a position to demonstrate the hybrid origin of some wild plants. There are now numerous cases in which certain wild orchids have been supposed, from the blending of morphological characters which they present, to have had a hybrid origin. Some botanists have hesitated to accept this kind of evidence, though we may say incidentally, that it has been borne out, in other genera, by Dr. Macfarlane's histological researches. More to the point is it to say that certain of these hybrid orchids have been actually artificially produced in Messrs. Veitch's nurseries by crossing the species that were reputed to be the parents of the supposed natural hybrids. The evidence is complete; and it alone is sufficient to show to the evolutionist what a vast and fertile field lies open to him in the observation, and especially in the experimental investigation of ordinary cultivated plants.

The reader will find numerous valuable hints and suggestions on the subject in Prof. Bailey's little book. It contains the substance of five lectures on variation and its causes, and on their application to the practical purposes of the cultivator. The most successful hybridisers and selectors act on a preconceived plan, according to their requirements; but since so much attention has been directed to the subject, there has been—indeed there always has been—much indiscriminate, haphazard experiment. Prof. Bailey cautions experimenters against such unscientific procedures, and supplies directions whereby the aim and purpose may more surely be attained.